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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: application of : Brown et al.
Serial No. : 08/621,631
Filed : March 26, 1996
For : Recovery of Metal Values
Art Unit : 3641
Examiner : Miller, E.

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Commissioner of Patents
P.O. Box 1450
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AMENDED APPEAL BRIEF

This is an Appeal Brief filed under 37 C.F.R. §41.37 in connection with the final rejection of claims 3 and 10-22 in the Final Office action mailed November 6, 2001. Each of the topics required by 37 C.F.R. §41.37 is presented herewith and is labeled appropriately.¹

Real Party in Interest

The real party in interest in the present application is the assignee, Cabot Corporation, 75 State Street, Boston, Massachusetts 02109 (hereinafter "Appellant").

¹ Appellant submitted a first Appeal Brief on October 7, 2002. In a Notification of Non-Compliance mailed September 2, 2004, the Examiner stated that the first Appeal Brief was not compliant with the provisions of 37 C.F.R. § 1.192(c). Subsequent to the first Appeal Brief, the rules governing practice before the Board of Patent Appeals and Interferences were revised. According to a clarification of the Effective Date Provision in the Rules of Practice before the Board of Patent Appeals and Interferences (Final Rule) Appellant may submit an amended appeal brief that complies with either former § 1.192(c) or § 41.37(c). Accordingly, this Amended Appeal Brief is submitted in compliance with §41.37.

Related Appeals and Interferences

The Appellant and the Appellant's legal representative know of no related appeals or interferences that will directly affect, will be directly affected by, or have a bearing on the Board's decision in this appeal.

Status of Claims

Claims 3 and 10-22 are pending in the application. Claims 3 and 10-22 stand finally rejected. The claims are set forth in the Appendix. Claim 10 is rejected under 35 U.S.C. § 102(b or e) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over, each of "Scandium Recovery From a Tantalum Waste Residue: A Status Report" by D.D. Harbuck and G.R. Palmer, U.S. Bureau of Mines (1991) ("Harbuck") and U.S. Patent No. 5,531,970 to Carlson ("Carlson '970"). Claims 3 and 10-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Carlson '970. The final rejection of claims 3 and 10-22 is appealed.

Status of Amendments

Applicant did not seek to amend the application after final rejection.

Summary of the Invention

The present invention provides processes for separation and selective recovery of metal values, such as scandium metal values, from metal containing materials such as ores, ore residues and slags which include the metal values. (Specification, page 1, line 38 to page 2, line 3) The processes are advantageous for selectively recovering metal values from fluoridated solids remaining after the conventional processing of ores, concentrates or slags.

The following paragraphs provide a concise explanation of the inventions set forth in the independent claims involved in the appeal.

According to claim 10, a process for selectively extracting scandium values from a source material which includes scandium values may comprise the steps of leaching the source material to solubilize the scandium values contained therein to generate an aqueous solution comprising solubilized scandium values. Specification page 2, lines 5-20; page 5, line 34 through page 6, line 6; page 9, lines 20-23. Once solubilized, the scandium values may be selectively extracted from the aqueous solution. Specification page 9, lines 20-23.

Claim 14 delineates a process for selectively extracting scandium metal values from a source material comprising scandium, fluorine, tantalum, and/or niobium metal values. Specification page 2, lines 13-19; page 3, lines 3-15. The process comprises the steps of:

a) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient to solubilize tantalum and niobium into solution and thereby generate a solution comprising tantalum and/or niobium metal values, and a remaining material at least partially depleted in tantalum and/or niobium and comprising fluorine and scandium metal values; Specification, page 3, lines 23-30; page 4, lines 20-34; page 13, lines 2-5.

b) separating and drying the remaining material; Specification, page 5, lines 11-13; page 13, line 6.

c) reacting the remaining material with a second mineral acid for a period of time, and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material at least partially depleted in fluorine values and comprising scandium metal values; Specification page 5, lines 15-31; page 13, lines 7-9.

d) reacting the sulfated material with water for a period of time, and under temperature and pressure conditions sufficient to generate an aqueous solution comprising scandium metal values; Specification page 5, line 34 through page 6, line 4; page 13, lines 10-12.

e) filtering the aqueous solution comprising scandium metal values to separate the solution from remaining solid material; Specification page 6, lines 5-25.

f) contacting the aqueous filtrate comprising solubilized scandium metal values with an organic medium which includes a diluent and an extractant, the diluent being immiscible with the aqueous filtrate thereby producing an organic phase comprising scandium metal values and an aqueous raffinate phase at least partially depleted in scandium metal values; Specification page 9, lines 24-28.

g) separating the organic phase comprising scandium metal values from the raffinate phase; Specification page 9, line 29.

h) stripping scandium metal values from the organic phase by contacting the organic phase with a scandium stripping agent thereby forming a scandium phase, an aqueous phase comprising the scandium stripping agent, and an organic phase comprising the diluent and extractant. Specification page 9, line 35 – page 10 line 1.

Claim 15 describes a process for selectively extracting scandium metal values from a sulfated starting material comprising the steps of:

a) reacting the sulfated material with water for a period of time and under temperature and pressure conditions sufficient to generate an aqueous solution comprising scandium metal values; Specification page 5, line 34 through page 6, line 4.

b) filtering the aqueous solution comprising scandium metal values to separate material solids from the aqueous solution; Specification page 6, lines 5-25.

c) contacting the aqueous solution comprising solubilized scandium metal values with an organic medium which includes a diluent and an extractant, the diluent being immiscible with the aqueous solution, thereby producing an organic phase comprising scandium metal values and an aqueous raffinate phase at least partially depleted in scandium metal values; Specification page 9, lines 24-28.

d) separating the organic phase comprising scandium metal values from the aqueous raffinate phase; Specification page 9, line 29.

e) stripping scandium metal values from the organic phase by contacting the organic phase with a scandium stripping agent, the stripping agent forming a scandium phase comprising scandium metal values from the organic phase, an aqueous phase

comprising the scandium stripping agent, and a final organic phase comprising the diluent and extractant. Specification page 9, line 35 through page 10, line 1.

Claim 21 recites a process for selectively extracting a metal value from a source material which includes fluorine and one or more solubilizable metal values, the solubilizable metal values including tantalum and niobium, the process comprising the steps of:

- a) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient to solubilize at least a portion of the tantalum or niobium metal values from the source material; Specification page 3, lines 23-30; page 4, lines 20-34.
- b) separating and drying the undissolved material; Specification page 5, lines 11-13.
- c) reacting the undissolved material with a second mineral acid comprising sulfuric acid for a period of time, and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material; Specification page 5, line 34 through page 6, line 4.
- d) leaching the sulfated material to solubilize at least a portion of the metal values contained therein and generate an aqueous solution comprising the solubilized metal values and a solid phase at least partially depleted in the solubilized metal values; Specification page 5, lines 34-38; page 6, lines 5-6.
- e) selectively extracting a solubilized metal value from the aqueous solution. Specification page 6, lines 6-7 and lines 35-38.

Claim 22 provides a process for selectively extracting a scandium metal value from an ore residue from a tantalum production process which includes fluorine, scandium, and one or more additional solubilizable metal values, the additional solubilizable metal values include tantalum or niobium metal values. Specification page 2, lines 14-19; page 3, lines 3-15. The process comprises the steps of:

- a) reacting the ore residue with a sulfuric acid solution to solubilize at least a portion of the tantalum or niobium metal values from the ore residue and produce an undissolved material; Specification page 2, lines 14-19.
- b) separating the undissolved material; Specification page 4, lines 27-28.
- c) separating and removing fluorine values from the ore residue by reacting the undissolved material with sulfuric acid for a period of time and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material; Specification page 5, lines 16-22.
- d) leaching the sulfated material in water to solubilize at least a portion of the scandium metal values contained therein and generate an aqueous solution comprising the solubilized scandium metal values and a solid phase at least partially depleted in the solubilized scandium metal values; Specification page 5, lines 34-38.
- e) selectively extracting solubilized scandium metal values from the aqueous solution by contacting the aqueous solution with a sodium hydroxide stripping agent to produce a solid phase comprising scandium metal values and separating the solid phase from the remaining aqueous solution; Specification page 9, lines 20-23; page 11, lines 9-19.
- f) drying and recovering the scandium metal values. Specification p. 11, lines 31-33.

Grounds of Rejection to be Reviewed on Appeal

1. Claim 10 stands rejected under 35 U.S.C. § 102(b or e) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over, each of Harbuck and Carlson '970.
2. Claims 3 and 10-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Carlson '970.

Argument

- 1. The rejection of Claim 10 under 35 U.S.C. § 102(b or e) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over, each of Harbuck and Carlson '970 is improper and should be overturned.**

Rejection of Claim 10 under 35 U.S.C. § 102(b or e)

A claimed invention is not patentable if "(b) the invention was patented or described in a printed publication in this or a foreign country ... more than one year prior to the date of the application for patent in the United States, or ... (e) the invention was described in a patent granted on an application for another filed in the United States before the invention thereof by the applicant for patent" 35 U.S.C. § 102 (b and e). Anticipation requires the claimed process, including each step thereof, be described or embodied, either expressly or inherently, in a single reference. *Glaverbel S.A. v. Northlake Mkt 'g & Supp., Inc.*, 33 USPQ2d 1496, 45 F.3d 1550 (Fed. Cir. 1995).

Claim 10 and Carlson '970 under 35 U.S.C. § 102(e)

In the Final Office Action mailed November 6, 2001, the Examiner states that claim 10 is anticipated by Carlson '970 pursuant to 35 U.S.C. § 102(e). More specifically, the Examiner directs attention to Example E, col. 15-16, where scandium is removed from a digestion liquor with DEHPA and then stripped with 2M NaOH, the scandium extraction being quantitative.²

Claim 10 of the present application recites:

A process for selectively extracting scandium values from a source of material which includes solubilizable scandium values, the process comprising the steps of:

² Final Office Action mailed November 6, 2001, page 2.

- a) leaching the source material to solubilize scandium values contained in the source material and generate an aqueous solution comprising said solubilized scandium values and a solid phase at least partially depleted in scandium; and
- b) selectively extracting a scandium value from said aqueous solution.

Carlson '970 fails to anticipate claim 10 pursuant to 35 U.S.C. § 102(e). Carlson '970 does not describe or embody the claim limitation of selectively extracting a scandium value from an aqueous solution as provided in section (b) of claim 10. The Examiner is correct in that Example E of Carlson '970 addresses the recovery of scandium values. The Examiner is incorrect, however, in his assertion that Carlson '970, through Example E, describes or embodies *selectively extracting a scandium value from an aqueous solution*. According to Carlson '970:

This example [Example E] illustrates both the decontamination of process liquor by extracting uranium and thorium and the recovery of non-radioactive metals such as scandium and zirconium. A liquor from the digestion of Tantalum/Niobium Leach residues was analyzed and found to contain Uranium [sic], thorium, scandium, zirconium, and titanium. A four-stage countercurrent extraction as performed by contacting ~180 ml of subject liquor with 50 ml of organic extractant, comprised of 5 v/o DEHPA*5 v/o TBP, 90 v/o kerosine. The 50 ml of fresh organic was added to stage 4 after each of the 5-180 ml aliquots were extracted in Stage 4. Following extraction, a 250 ml sample of pregnant organic was collected and contacted with 200 ml of 2M NaOH to strip metal values from the organic phase.³

The four stage countercurrent extraction as described above is illustrated in Figure 4 of Carlson '970. Example E in conjunction with Figure 4 reveals that the secondary metal values solubilized in the Tantalum/Niobium digestion liquor comprising uranium,

³ Carlson '970 column 15, line 65 – column 16 line 9.

thorium, scandium, zirconium, and titanium are simultaneously extracted into the organic phase. The extraction of each of these metal values into the organic phase generates a non-radioactive aqueous phase of digest liquor containing few secondary values as displayed in Stage IV of Figure 4. From this point, the organic phase comprising uranium, thorium, scandium, zirconium, and titanium is treated with 2M NaOH to precipitate the metal values. Stripping the organic phase with 2M NaOH quantitatively removes the uranium and thorium metal values along with zirconium metal values. More importantly, the use of 2M NaOH additionally precipitates scandium metal values with the uranium, thorium, and zirconium. The precipitation of scandium with NaOH is easily predicted as the solubility product constant (K_{sp}) of $\text{Sc}(\text{OH})_3$ is 8.0×10^{-31} . The specification acknowledges the co-precipitation of scandium metal values by stating that “scandium values are also quantitatively extracted.”⁴

Nowhere in Example E is it stated that a scandium metal value is selectively extracted as recited in claim 10. Selective extraction of scandium is not recited since the extraction process in Example E is incapable of providing for the selective extraction of scandium. The organic extractant is not selective to uranium, thorium, scandium, or zirconium. Additionally, the 2M NaOH utilized in the stripping process is not selective to uranium, thorium, scandium, or zirconium. Hydroxide possesses the ability to precipitate all the metal values. This is reflected in the language of Example E where it states “[t]he metal constituents are efficiently recovered as solid concentrate i.e. strip solids by the stripping process.”⁵ The use of the plural “metal constituents” and “strip solids” as opposed to the singular “metal constituent” and “strip solid” indicates that all the metal values in the organic phase are co-precipitated demonstrating the lack of selectivity in using hydroxide as the stripping agent. The table in Column 16 lines 15-30 confirms the co-precipitation of uranium, thorium, scandium, and zirconium by providing concentrations of these metal values in the strip solids produced from the process.

Furthermore, the specification of Carlson ‘970 outside of Example E does not describe or embody the selective extraction of a scandium value as recited in claim 10 of the present application. The only other place in the specification of Carlson ‘970 where

⁴ *Id.* at column 16, lines 33-34.

⁵ *Id.* at column 16, lines 34-36.

scandium extraction is mentioned is in Example F (column 16-column 17), which addresses the selective extraction of uranium and thorium from the process liquor. The selective uranium and thorium extraction of Example F demonstrates that scandium and zirconium values remain in the extracted digest liquor. The specification recites “the decontaminated liquor, with uranium and thorium removed, can be submitted for further processing to extract a scandium product that contains substantially reduced radioactivity.”⁶ This statement, at first glance, may seem to read on claim 10. Upon closer examination, however, this statement does not recite the *selective* extraction of a scandium product. The absence of the recitation of a *selective* extraction is especially relevant since zirconium is present with scandium in the digest liquor, and the only precipitating agent disclosed for scandium in the specification of Carlson ‘970 is hydroxide which does not demonstrate selectivity between scandium and zirconium. This being the case, a selective extraction of scandium product cannot be implied from the text in Example F since scandium co-precipitation with zirconium can yield a scandium product that contains substantially reduced radioactivity. Moreover, the recitation of “further processing” to extract a scandium product is ambiguous at best and does not indicate that the extraction is selective.

In light of the foregoing discussion, Carlson ‘970 does not recite, describe, or embody a process for selectively extracting a scandium value from an aqueous solution. As a result, Carlson ‘970 does not anticipate claim 10 pursuant to 35 U.S.C. § 102(e), and the rejection should be reversed.

Claim 10 and Harbuck under 35 U.S.C. § 102(b)

In the Final Office Action mailed November 6, 2001, the Examiner additionally rejected claim 10 as being anticipated by Harbuck et al. pursuant to 35 U.S.C. § 102(b). The Examiner cites the use of strong sulfuric acid, extraction with DEHPA, and stripping with NaOH in rejecting claim 10 as anticipated.

Harbuck fails to anticipate claim 10 of the present application. Similar to Carlson ‘970, Harbuck does not describe or embody the claim limitation of selectively extracting

⁶ *Id.* at column 16-column 17.

a scandium value from said aqueous solution as provided in section (b) of claim 10. The Examiner is correct in that Harbuck recites that “[s]olvent extraction test work to selectively recover scandium from the water leach filtrate was performed in glass separatory funnels on a wrist action shaker.”⁷ The Examiner is incorrect, however, in stating that this recitation is anticipatory of claim 10. Examination of the statement reveals that it means exactly what it says. Solvent extraction test work to selectively recover scandium from water leach filtrate was performed. This does not mean that selective extraction of scandium values was ever achieved or described in Harbuck. The word “test” is used in the statement since various solvents and stripping agents were “tested” to determine their respective abilities to selectively extract scandium metal values from an aqueous solution containing a plurality of metal values.

Under 35 U.S.C. § 102, anticipation requires that the prior art reference must be enabling, thus placing the allegedly disclosed matter in the possession of the public. *Akzo N.V. v. United States Int’l Trade Comm’n*, 808 F.2d 1471, 1 USPQ2d 1241, 1245 (Fed. Cir. 1986)(citing *In re Brown*, 329 F.2d 1006, 1011, 141 USPQ 245, 249 (CCPA 1964). The results of the solvent extraction tests demonstrate that Harbuck does not enable or describe a process for selectively extracting a scandium value from an aqueous solution as recited in claim 10. According to Harbuck, six different common organic extractants were examined to determine their selectivity for loading scandium from the water leach sulfated material.⁸ Out of the six organic extractants, DEHPA was the most effective in extracting scandium metal values. DEHPA, however, was additionally effective in extracting zirconium metal values from an aqueous solution. The efficacy of DEHPA in extracting scandium and zirconium metal values is displayed in Table VI of Harbuck as well as in Figures 3 and 4. DEHPA is not selective for scandium as it is operable to extract significant amounts of zirconium along with scandium when exposed to an aqueous solution comprising these metal values.

Moreover, the stripping of the DEHPA in Harbuck does not result in the selective extraction of a scandium metal value. Harbuck discloses that the DEHPA may be stripped with various concentrations of NaOH in completing the extraction of scandium

⁷ Harbuck et al., page 109.

⁸ Harbuck at 113.

metal values. According to Harbuck, the stripping of the DEHPA with NaOH does not result in the selective extraction of a scandium metal value. Table VIII in Harbuck displays that 100 percent of the zirconium in the DEHPA is co-precipitated with the scandium values.

The failure to enable a process for the selective extraction of a scandium value precludes Harbuck from reciting, describing, or embodying this claim limitation as recited in section (b) in claim 10. As a result, Harbuck does not anticipate claim 10 under 35 U.S.C. § 102(b), and the rejection should be reversed.

Rejection of Claim 10 under 35 U.S.C. § 103(a)

A claimed invention is not patentable as obvious “if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.” 35 U.S.C. § 103(a). The ultimate decision on obviousness is a “legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness.” *In re Huang*, 40 USPQ2d 1685, 1687-88, 100 F.3d 135, 138 (Fed. Cir. 1996) (citing *Graham v. John Deere Co.*, 148 USPQ 459, 467, 383 U.S. 1, 17-18 (1966)). Moreover, to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

Claim 10 and Carlson ‘970 under 35 U.S.C. § 103(a)

In the Final Office Action mailed November 6, 2001, the Examiner rejected claim 10 as being unpatentable over Carlson ‘970 under 35 U.S.C. § 103(a). In rejecting claim 10 under § 103(a), the Examiner again references Example E in conjunction with Example B of Carlson ‘970 as rendering claim 10 obvious.

The rejection of claim 10 over Carlson '970 is improper as the Examiner has failed to establish a prima facie case of obviousness. As recited above, to establish a prima facie case of obviousness, all the claim limitations must be taught or suggested by the prior art. Carlson '970 does not teach or suggest the limitation of claim 10 of selectively extracting a scandium value from an aqueous solution. As previously discussed, nowhere in Example E is the selective extraction of a scandium value taught or suggested. The process in Example E is incapable of providing a selective extraction of scandium values thereby demonstrating its failure to contemplate such an extraction. The process described in Example E utilizes DEHPA as the organic extractant, which displays no selectivity in extracting solubilized metals from the digest liquor. According to Example E, the DEHPA extracts scandium, zirconium, uranium, and thorium from the digest liquor. Moreover, the 2M NaOH utilized to strip the metal values from the organic layer in completing the extraction process demonstrates no selectivity as scandium, zirconium, uranium, and thorium are all precipitated from the organic phase. The non-selective nature of the reagents utilized in Carlson '970 do not provide a teaching or suggestion for the selective extraction of a scandium value.

Furthermore, the specification of Carlson '970 outside of Example E does not teach or suggest the selective extraction of a scandium value as recited in claim 10 of the present application. The only other place in the specification of Carlson '970 where scandium extraction is mentioned is in Example F (column 16-column 17), which addresses the selective extraction of uranium and thorium from the process liquor as opposed to scandium. The selective uranium and thorium extraction of Example F demonstrates that scandium and zirconium values remain in the extracted digest liquor. The specification recites "the decontaminated liquor, with uranium and thorium removed, can be submitted for further processing to extract a scandium product that contains substantially reduced radioactivity."⁹

This statement may seem to suggest or teach the selective limitation of claim 10. Upon closer examination, however, this statement does not teach or suggest the *selective* extraction of a scandium product. The absence of a explicit language describing a *selective* extraction is especially relevant since zirconium is present with scandium in the

⁹ Carlson '970 at column 16-column 17.

digest liquor, and the only precipitating agent disclosed for scandium in the specification of Carlson '970 is hydroxide which does not demonstrate selectivity between scandium and zirconium. As a result, a selective extraction of scandium product cannot be taught or suggested from the text in Example F absent an explicit recitation since no mechanism is described to selectively precipitate scandium from zirconium. Co-precipitation of scandium with zirconium can yield a scandium product that contains substantially reduced radioactivity. Additionally, the recitation of "further processing" to extract a scandium product is ambiguous at best and does not teach that the extraction is selective.

Carlson '970 cannot be held to teach or suggest a process for the selective extraction of scandium where it completely fails to contemplate achieving such a result. Therefore, Carlson '970 does not render claim 10 obvious under 35 U.S.C. § 103(a) and the rejection should be reversed.

Claim 10 and Harbuck under 35 U.S.C. § 103(a)

In the Final Office Action mailed November 6, 2001, the Examiner rejected claim 10 as being unpatentable over Harbuck under 35 U.S.C. § 103(a). In rejecting claim 10 over Harbuck, the Examiner fails to establish a prima facie case of obviousness.

As described above, in order to establish a prima facie case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. Moreover, the prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Harbuck fails to satisfy both these requirements in attempting to establish a prima facie case of obviousness.

Similar to Carlson '970, Harbuck does not teach or suggest the limitation of claim 10 of selectively extracting a scandium value from an aqueous solution. Harbuck recites that extraction test work to selectively recover scandium from a water leach filtrate was performed. The results of this test work, however, demonstrate that Harbuck does not teach or suggest a process for selectively extracting a scandium value from an aqueous solution as recited in claim 10.

According to Harbuck, six different common organic extractants were examined to determine their selectivity for loading scandium from the water leach sulfated material.¹⁰ Out of the six organic extractants, DEHPA was the most effective in extracting scandium metal values. DEHPA, however, was additionally effective in extracting zirconium metal values from an aqueous solution. The efficacy of DEHPA in extracting scandium and zirconium metal values is displayed in Table VI of Harbuck as well as in Figures 3 and 4. DEHPA is not selective for scandium as it is operable to extract significant amounts of zirconium along with scandium when exposed to an aqueous solution comprising these metal values.

Moreover, the stripping of the DEHPA in Harbuck does not result in the selective extraction of a scandium metal value. Harbuck discloses that the DEHPA may be stripped with various concentrations of NaOH in completing the extraction of scandium metal values. According to Harbuck, the stripping of the DEHPA with NaOH does not result in the selective extraction of a scandium metal values. Table VIII in Harbuck displays that 100 percent of the zirconium in the DEHPA is co-precipitated with the scandium values.

The failure of all the organic extractants and stripping agents to selectively extract a scandium value from an aqueous solution precludes Harbuck from teaching or suggesting the claim limitation of section (b) in claim 10.

Furthermore, the fact that all the processes failed to selectively extract scandium metal values precludes a finding that Harbuck can be modified with a reasonable expectation of success to arrive at the invention recited in claim 10. The purpose in the Harbuck reference is to investigate and identify the best method of extracting scandium metal values from tantalum waste residues. This purpose is stated in the abstract of Harbuck where it recites “[a] variety of operating parameters were evaluated to determine the best technique of for recovering scandium.” Moreover, the title of the Harbuck reference is *Scandium Recovery from a Waste Residue: A Status Report*. After investigating many processes, Harbuck ultimately concludes that the best technique for recovering scandium metal values from an aqueous tantalum waste residue is with DEHPA followed by treatment with 3M NaOH. In particular, Harbuck recites:

¹⁰ Harbuck at 113.

Successful research to date has revealed the following:

A common industrial solvent DEHPA, selectively extracted 100 percent of the scandium and 78 percent of the zirconium from 60-g/L H_2SO_4 leach solution while leaving other metals such as iron, tantalum, and niobium in the raffinate. This extraction occurred in as little as 1 min with a 10-vol percent DEHPA in kerosene organic at an A-O ratio of 1:1.¹¹

Harbuck recognizes the fact that scandium is not selectively extracted as the 3M NaOH treatment precipitates 100 percent of both the scandium and zirconium metal values in the DEHPA.¹² Co-precipitation requires further processing to isolate the scandium metal values.

The process of claim 10 is advantageous to the process of Harbuck since it precludes co-precipitation of zirconium as scandium is selectively extracted. It stands to reason that if modification of the process in Harbuck to arrive at the present invention is obvious, as the Examiner contends, then Harbuck should disclose the selective extraction of scandium metal values as described in claim 10. After all, the purpose behind Harbuck study is to identify the best process for extracting scandium metal values from a tantalum waste residue. Harbuck does not teach or suggest the process of the present invention since there is no reasonable expectation of success in modifying the process of Harbuck to arrive at a process commensurate with claim 10. As a result, Harbuck fails to render claim 10 obvious under 35 U.S.C. § 103(a), and the rejection should be reversed.

2. The rejection of Claims 3 and 10-22 under 35 U.S.C. § 103(a) as being unpatentable over Carlson '970 is improper and should be overturned.

A claimed invention is not patentable as obvious "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a

¹¹ *Id.* at 117.

¹² *Id.* at 116.

whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.” 35 U.S.C. § 103(a) (1994). The ultimate decision on obviousness is a “legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness.” *In re Huang*, 40 USPQ2d 1685, 1687-88, 100 F.3d 135, 138 (Fed. Cir. 1996) (citing *Graham v. John Deere Co.*, 148 USPQ 459, 467, 383 U.S. 1, 17-18 (1966)). Moreover, to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

In rejecting claims 3, and 10-22 as being unpatentable under 35 U.S.C. § 103(a), the Examiner cites column 3, lines 1-30 and column 5, lines 17-20 of Carlson ‘970 as teaching a source material and Example B in column 10 as teaching reacting the source material. Moreover, the Examiner states that eventual recovery of scandium and organo-phosphate extraction is taught in Example E in columns 15-16 of Carlson ‘970.

Claim 10 and 35 U.S.C. § 103(a)

The Appellant refers the Board to the previous arguments made in Issue 1 regarding the rejection of claim 10 as being unpatentable over Carlson ‘970 under 35 U.S.C. § 103(a).

Claims 11-13 and 16-20 and 35 U.S.C. § 103(a)

Claim 11 recites:

The process of claim 10 wherein the source material further comprises fluorine, tantalum and/or niobium and step a) further comprises the steps of:

- a1) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and

pressure conditions sufficient, to *solubilize* at least a portion of tantalum and niobium metal values from the starting material and create a solution comprising tantalum and niobium metal values and a solids residue comprising fluorine and scandium metal values, and at least partially depleted in tantalum and niobium metal values;

a2) separating and drying the solids residue

a3) reacting the solids residue with a second mineral acid comprising sulfuric acid for a period of time, and under temperature and pressure conditions sufficient, to liberate hydrogen fluoride gas and to generate a sulfated material comprising scandium metal values and at least partially depleted fluorine metal values; and

a4) leaching the sulfated material to solubilize scandium metal values contained in the sulfated material and generate said aqueous solution comprising scandium metal values and a solid phase at least partially depleted in scandium.

The Examiner's citation of Carlson '970 is not sufficient to render claim 11 *prima facie* obvious. If the proposed modification or combination of the prior art would change the principle of operation of the prior art being modified, then the teachings of the references are not sufficient to render claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). In accordance with the presently cited case law, modification of Carlson '970 to arrive at the invention recited in claim 11 changes the principle of operation of the processes disclosed in Carlson '970 thereby precluding a finding of obviousness over this reference.

Carlson '970 recites in relevant part:

[a] process for separating primary values of Ta and Nb from at least one of secondary values of U or Th, and from one or more secondary values from the group consisting of Sc, Zr, Ti or other values of non-radioactive

metals, all of the aforesaid values being contained in highly fluorinated ore feed materials said processing comprising:

- (a) contacting said feed materials with an aqueous, acidic digest medium containing one or more complexing materials selected from the group consisting of H_3BO_3 or ions of group 2A, 3A, 4A, 5A, 6A, or 7A metals, Fe, B, Al, or Si...
- (c) reacting said materials with said medium for a sufficient period to solubilize the major portion of said secondary values and to leave said Ta or Nb values substantially *insolubilized* in said medium;
- (d) separating the solids containing said Ta or Nb values from said medium to provide a digest liquor containing said solubilized secondary values...¹³

As described above, Carlson '970 recites a process wherein tantalum and niobium metal values are rendered insoluble in the digestion mixture while secondary metal values such as scandium and zirconium are solubilized in the digestion mixture with the assistance of a complexing agent that frees the scandium and zirconium from the insoluble fluoride matrix. This scenario is reiterated in Example B, which the Examiner cites in the rejection of claim 11. Figure 4 of Carlson '970 additionally illustrates a process consistent with the above description.

Modification of Carlson '970 to arrive at the invention of claim 11 would change its principle of operation since in the process of claim 11, tantalum and niobium metal values are solubilized while the secondary metal values comprising scandium remain insoluble in the digestion media. This is in direct opposition to the principle of operation disclosed in Carlson '970 where secondary metal values are solubilized and tantalum and niobium metal values remain insoluble. Moreover, modification of Carlson '970 to reflect the process of claim 11 would obviate the need for a complexing agent to assist in the solvation of secondary metal values since in the process of claim 11 secondary metal values are solubilized through a roasting treatment in sulfuric acid. The complexing agent is inherent to the principle of operation of Carlson '970 since it is responsible for

¹³ Carlson '970 column 5, lines 24-59.

effectuating the solvation of secondary metal values in this reference. Since modification of Carlson '970 to arrive at the invention of claim 11 changes its principle of operation, the teachings of Carlson '970 are insufficient to render claim 11 *prima facie* obvious.

Furthermore, if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Modification of Carlson '970 to arrive at the invention recited in claim 11 would render the processes of Carlson '970 unfit for its intended purpose of separating primary values of tantalum and niobium from at least one of secondary metal values of uranium, thorium, scandium, zirconium, or titanium.¹⁴ Modification of Carlson '970 to be commensurate with the process of claim 11 would require tantalum and niobium metal values to be solubilized in the digestion liquor. Solubilization of tantalum and niobium metal values in the digestion liquor would preclude the ability of the process in Carlson '970 to separate primary values of tantalum and niobium from at least one secondary value of uranium, thorium, scandium, zirconium, or titanium as these secondary metal values are also solubilized in the digestion liquor. As a result, such a modification would render Carlson '970 unsatisfactory for its intended purpose thereby precluding a suggestion or motivation to make the proposed modification.

In light of the foregoing discussion, Carlson '970 does not render claim 11 obvious under 35 U.S.C. § 103(a), and the rejection should be reversed. Moreover, as claims 12, 13, and 16-20 depend from and further limit claim 11, Appellant respectfully asserts that these claims are not rendered obvious over Carlson '970 and respectfully request that the rejection of these claims be reversed.

Claim 14 and 35 U.S.C. § 103(a)

Claim 14 recites in part:

- a) reacting the source material with a solution of first mineral acid
for a period of time, and under temperature and pressure
conditions sufficient to solubilize tantalum and niobium into

¹⁴ *Id.*

solution and thereby generate a solution comprising tantalum and/or niobium metal values, and a remaining material at least partially depleted in tantalum and/or niobium and comprising fluorine and/or scandium metal values;

Appellant directs the Board to the arguments presented in the discussion of claims 11-13 and 16-20 as modification of Carlson '970 to arrive at the invention recited in claim 14 changes the principle of operation of the processes disclosed in Carlson '970 and additionally renders Carlson '970 unsatisfactory for its intended purpose. As a result, claim 14 is not unpatentable over Carlson '970 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Claim 15 and 35 U.S.C. § 103(a)

Claim 15 recites a process for selectively extracting scandium metal values from a sulfated starting material. The rejection of claim 15 over Carlson '970 is improper as the Examiner has failed to establish a prima facie case of obviousness. As previously discussed, to establish a prima facie case of obviousness, all the claim limitations must be taught or suggested by the prior art. For reasons consistent with those provided in the discussion of claim 10 in relation to Carlson '970 under § 103(a), Appellant respectfully asserts that Carlson '970 does not teach or suggest the selective extraction of a scandium metal value. Appellant directs the Board to the arguments presented in the discussion of claim 10 in relation to Carlson '970 under § 103(a), which are found in Issue 1 above. In failing to teach or suggest the selective extraction of a scandium metal value, Carlson '970 does not render claim 15 unpatentable under § 103(a), and Appellant respectfully requests that the rejection be reversed.

Claims 3 and 21 and 35 U.S.C. § 103(a)

Claim 21 recites in part:

- a) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient, to solubilize at least a portion of the tantalum or niobium metal values from the source material;

Appellant directs the Board to the arguments presented in the discussion of claims 11-13 and 16-20 as modification of Carlson '970 to arrive at the invention recited in claim 21 changes the principle of operation of the processes disclosed in Carlson '970 and additionally renders Carlson '970 unsatisfactory for its intended purpose. As a result, claim 21 is not unpatentable over Carlson '970 under 35 U.S.C. § 103(a), and the rejection should be reversed. As claim 3 depends from and further limits claim 21, which is patentable over Carlson '970, Appellant respectfully asserts that claim 3 is additionally patentable over Carlson '970 and respectfully request that the rejection of this claim be reversed.

Claim 22 and 35 U.S.C. § 103(a)

Claim 22 recites in part:

- a) reacting the ore residue with sulfuric acid solution to solubilize at least a portion of the tantalum or niobium metal values from the ore residue and produce an undissolved material;

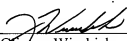
Appellant directs the Board to the arguments presented in the discussion of claims 11-13 and 16-20 as modification of Carlson '970 to arrive at the invention recited in claim 22 changes the principle of operation of the processes disclosed in Carlson '970 and additionally renders Carlson '970 unsatisfactory for its intended purpose. As a result, claim 22 is not unpatentable over Carlson '970 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Conclusion

In view of the foregoing arguments, it is submitted that the rejection of Claims 3 and 10-22 are improper and should not be sustained. A reversal, therefore, of the Final Rejection of the Examiner is respectfully requested.

Respectfully submitted,

12/29/04
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APPENDIX – Claims

3. The process of claim 21 wherein the step d) of leaching the sulfated material further comprises:

d1) reacting the sulfated material with water for a period of time, and under temperature and pressure conditions sufficient to generate said aqueous solution comprising the one or more other solubilized metal values; and

d2) filtering said aqueous solution comprising the one or more other solubilized metal values to separate remaining material solids from said aqueous solution.

10. A process for selectively extracting scandium values from a source material which includes solubilizable scandium values, the process comprising the steps of:

a) leaching the source material to solubilize scandium values contained in the source material and generate an aqueous solution comprising said solubilized scandium values and a solid phase at least partially depleted in scandium; and

b) selectively extracting a scandium value from said aqueous solution.

11. The process of claim 10 wherein the source material further comprises fluorine, tantalum and/or niobium and step a) further comprises the steps of:

a1) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient, to solubilize at least a portion of tantalum and niobium from the starting material and create a solution comprising tantalum and niobium metal values and a solids residue comprising fluorine and scandium metal values, and at least partially depleted in tantalum and niobium metal values;

a2) separating and drying the solids residue

a3) reacting the solids residue with a second mineral acid comprising sulfuric acid for a period of time, and under temperature and pressure conditions sufficient, to liberate hydrogen fluoride gas and to generate a sulfated material comprising scandium metal values and at least partially depleted in fluorine metal values; and

a4) leaching the sulfated material to solubilize scandium metal values contained in the sulfated material and generate said aqueous solution comprising scandium metal values and a solid phase at least partially depleted in scandium.

12. The process of claim 11 wherein the step a4) of leaching the sulfated material comprises the steps of:

a4a) reacting the sulfated material with water for a period of time, and under temperature and pressure conditions sufficient to generate said aqueous solution comprising solubilized scandium metal values; and

a4b) filtering said aqueous solution comprising solubilized scandium metal values to separate remaining material solids from said aqueous solution.

13. The process of claim 12 wherein the step b) of selectively extracting a scandium metal value from said aqueous solution comprising solubilized scandium metal values comprises the steps of:

b1) contacting said aqueous solution comprising solubilized scandium metal values with an organic medium which includes a diluent and an extractant, said diluent being immiscible with said aqueous solution, thereby producing an organic phase comprising scandium metal values and an aqueous raffinate phase at least partially depleted in scandium metal values;

b2) separating said organic phase from said raffinate phase;

b3) stripping scandium from said organic phase by contacting said organic phase with a scandium stripping agent, said scandium stripping forming a phase comprising scandium from said resultant organic phase and an aqueous phase comprising said scandium stripping agent and a final organic phase.

14. A process for selectively extracting scandium metal values from a source material comprising scandium, fluorine, tantalum and/or niobium metal values the process comprising the steps of:

a) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient to solubilize

tantalum and niobium into solution and thereby generate a solution comprising tantalum and/or niobium metal values, and a remaining material at least partially depleted in tantalum and/or niobium and comprising fluorine and/or scandium metal values;

- b) separating and drying the remaining material;
- c) reacting the remaining material with a second mineral acid for a period of time, and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material at least partially depleted in fluorine metal values and comprising scandium metal values;
- d) reacting the sulfated material with water for a period of time, and under temperature and pressure conditions sufficient to generate an aqueous solution comprising scandium metal values;
- e) filtering said aqueous solution comprising scandium metal values to separate remaining material solids from the aqueous solution;
- f) contacting said aqueous solution resulting from step e) comprising solubilized scandium metal values with an organic medium which includes a diluent and an extractant, said diluent being immiscible with said aqueous solution resulting from step e), thereby producing an organic phase comprising scandium metal values and an aqueous raffinate phase at least partially depleted in scandium metal values;
- g) separating said organic phase from step f) comprising scandium metal values from said raffinate phase at least partially depleted in scandium metal values;
- h) stripping scandium metal values from said organic phase by contacting said organic phase from step g) with a scandium stripping agent, said stripping forming a scandium phase comprising scandium metal values from said organic phase, an aqueous phase comprising said scandium stripping agent and a final organic phase comprising said diluent and said extractant.

15. A process for selectively extracting scandium metal values from a sulfated starting material which includes scandium metal values comprising the steps of:

- a) reacting the sulfated material with water for a period of time, and under temperature and pressure conditions sufficient to generate an aqueous solution comprising scandium metal values;

- b) filtering said aqueous solution comprising scandium metal values from step a) to separate material solids from the aqueous solution;
- c) contacting said aqueous solution from step b) comprising solubilized scandium metal values with an organic medium which includes a diluent and an extractant, said diluent being immiscible with said aqueous solution, thereby producing an organic phase comprising scandium metal values and an aqueous raffinate phase at least partially depleted in scandium metal values;
- d) separating said organic phase comprising scandium metal values generated in step c) from said raffinate phase at least partially depleted scandium metal values;
- e) stripping scandium metal values from said organic phase by contacting said organic phase from step d) with a scandium stripping agent, said stripping forming a scandium phase comprising scandium metal values from said organic phase, an aqueous phase comprising said scandium stripping agent and a final organic phase comprising said diluent and said extractant.

16. The process of claim 10 wherein the source material in step a) is an ore residue further comprising fluorine, tantalum and/or niobium and step a) further comprises the steps of:

- a1) reacting the ore residue with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient, to solubilize at least a portion of tantalum and niobium from the source material and create a solution comprising tantalum and niobium metal values and a solids residue comprising fluorine and scandium metal values and at least partially depleted in tantalum and niobium metal values;
 - a2) separating and drying the solids residue generated in step a1);
 - a3) reacting the solids residue from step a2) with a second mineral acid comprising sulfuric acid for a period of time, and under temperature and pressure conditions sufficient, to liberate hydrogen fluorine gas and to generate a sulfated material comprising scandium metal values and at least partially depleted in fluorine metal values;
- and

a4) and leaching the sulfated material to solubilize scandium metal values contained in the sulfated material and generate said aqueous solution comprising scandium metal values and a solid phase at least partially depleted in scandium metal values.

17. The process of claim 16 wherein the first mineral acid in step a1) comprises sulfuric acid.

18. The process of claim 17 wherein the step b) of extracting a scandium metal value from said aqueous solution comprises:

b1) contacting said aqueous solution with an organic medium which includes a diluent and an extractant, said diluent being immiscible with said aqueous solution thereby producing an organic phase comprising scandium metal values and a raffinate at least partially depleted in scandium metal values; and

b2) contacting said organic phase generated in step b1) with a scandium stripping agent to form a scandium phase comprising at least a portion of the scandium metal values present in said organic phase; an additional aqueous phase comprising said scandium stripping agent; and a final organic phase at least partially depleted in scandium metal values.

19. The process of claim 18 wherein the organic medium of step b1) comprises DEPHA (Di 2-ethylhexylphosphoric acid) as an extractant and an aliphatic non-soluble C9-c16 hydrocarbon as a diluent.

20. The process of claim 19 wherein the scandium stripping agent of step b2) comprises sodium hydroxide.

21. A process for selectively extracting a metal value from a source material which includes fluorine and one or more solubilizable metal values, the solubilizable metal values including tantalum or niobium metal values, the process comprising the steps of:

- a) reacting the source material with a solution of a first mineral acid for a period of time, and under temperature and pressure conditions sufficient, to solubilize at least a portion of the tantalum or niobium metal values from the source material;
- b) separating and drying the undissolved material;
- c) reacting the undissolved material from step b) with a second mineral acid comprising sulfuric acid for a period of time, and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material;
- d) leaching the sulfated material from step c) to solubilize at least a portion of the metal values contained therein and generate an aqueous solution comprising said solubilized metal values and a solid phase at least partially depleted in the solubilized metal values; and
- e) selectively extracting a solubilized metal value from said aqueous solution.

22. A process for selectively extracting a scandium metal value from an ore residue from a tantalum production process which includes fluorine, scandium and one or more additional solubilizable metal values, the additional solubilizable metal values include tantalum or niobium metal values, the process comprising the steps of:

- a) reacting the ore residue with a sulfuric acid solution to solubilize at least a portion of the tantalum or niobium metal values from the ore residue and produce an undissolved material;
- b) separating the undissolved material from step a);
- c) separating and removing fluorine values from the ore residue by reacting the undissolved material from step b) with sulfuric acid for a period of time, and under temperature and pressure conditions sufficient to liberate hydrogen fluoride gas and to generate a sulfated material;
- d) leaching the sulfated material from step c) in water to solubilize at least a portion of the scandium metal values contained therein and generate an aqueous solution comprising said solubilized scandium metal values and a solid phase at least partially depleted in the scandium solubilized metal values;

- e) selectively extracting solubilized scandium metal values from said aqueous solution generated in step d) by contacting said aqueous solution with a sodium hydroxide stripping agent to produce a solid phase comprising scandium metal values and separating the solid phase from the remaining aqueous solution; and
- f) drying and recovering the scandium metal values.